Neighborhood social capital and individual health

Mohnen, S.M.; Groenewegen, P.P.; Völker, B.G.M.; Flap, H.D.

Published in:
Social Science & Medicine

DOI:
10.1016/j.socscimed.2010.12.004

Publication date:
2010

Social Science & Medicine 72 (2011) 660–667

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Neighborhood social capital and individual health

Sigrid M. Mohnen [a,*], Peter P. Groenewegen [a,b], Beate Völker [a], Henk Flap [a]

[a] Department of Sociology/ICS, Utrecht University, Heidelberglaan 2, 3584CS Utrecht, The Netherlands
[b] Nivel – Netherlands Institute for Health Service Research, Otterstraat 118 – 124, 3513CR Utrecht, The Netherlands

ARTICLE INFO

Article history:
Available online 16 December 2010

Keywords:
Collective social capital
Self perceived health
The Netherlands
Ecometrics
Small area
Urbanity
Neighborhood

ABSTRACT

Neighborhood social capital is increasingly considered to be an important determinant of an individual's health. Using data from the Netherlands we investigate the influence of neighborhood social capital on an individual's self-reported health, while accounting for other conditions of health on both the level of the neighborhood and the individual. We use national representative data ('The Housing and Living Survey', 2006) on the Netherlands with 61,235 respondents in 3273 neighborhoods. The cross-sectional data were combined with information provided by Statistics Netherlands on neighborhoods, i.e., the percentage of residents in the highest income quintile per neighborhood and the municipality's degree of urbanity. The association of neighborhood social capital with individual health was assessed by multilevel logistic regression analysis. Our results show that neighborhood social capital is positively associated with health. Interestingly, residents in urban neighborhoods benefit particularly from their neighborhood social capital.

Introduction

In recent decades, research on local contexts, such as neighborhoods, and their association with various individual outcomes, e.g., fertility (Mayer & Jencks, 1989), career (cf. Wilson, 1996), well being (Völker, Flap, & Lindenberg, 2007), or deviance (Chung & Steinberg, 2006), has become an extensive and important field of study in the social sciences. More specifically, in health sciences, interest in neighborhood conditions and their impact on individual health has grown enormously. There are two general strands of literature in the field of neighborhood effects on health: one is directed toward the influence of socio-economic neighborhood conditions on health, e.g., prosperity; the other focuses on conditions related to the physical environment, e.g., pollution.

Studies from North America on the first type of explanation of ill health, that is, low prosperity (Diez-Roux et al., 1997; Wen, Cagney, & Christakis, 2005), have convincingly shown that neighborhood prosperity matters for various kinds of health outcomes. Also, within Western European countries, where health care systems are highly developed, living in deprived neighborhoods is associated with increased ill health irrespective of an individual's own socio-economic position (Malmström, Sundquist, & Johansson, 1999; Van Lenthe & Mackenbach, 2002).

Studies on the second type of explanation, that is, health being negatively affected by the physical characteristics of the environment such as home maintenance or environmental pollution, also showed an influence on individual health. The physical qualities of one's living environment substantially affect health (see, e.g., Beelen et al., 2008).

It has also been suggested that next to socio-economic and physical conditions, social conditions in the neighborhood also matter for individual health (Fagg et al., 2008; Halpern, 2005; Kawachi, Subramanian, & Kim, 2008; Stafford, De Silva, Stansfeld, & Marmot, 2008; Subramanian, Lochner, & Kawachi, 2003; Van Hooijdonk, Droomers, Deerenberg, Mackenbach, & Kunst, 2008; Veenstra et al., 2005; Wen et al., 2005). In particular, social capital in a neighborhood is expected to influence individual health. Thus, the role of neighborhood social capital for individual health is an expanding research area in social epidemiology. Furthermore, existing studies show limitations regarding the measurements of social capital (Fagg et al., 2008) or the number of neighborhoods in the sample (Veenstra et al., 2005). A British multilevel study of 239 neighborhoods showed an association between neighborhood social capital and mental health for economically deprived residents (Stafford, De Silva, Stansfeld, & Marmot, 2008). Until now, outside the UK and North America, relatively few studies of neighborhood social capital and its association with physical health have been based on a representative sample of neighborhoods while taking into account additional neighborhood characteristics that also might affect people's health. However, not adjusting for the influence on health of relevant social-economic as well as

* Corresponding author. Tel.: +31 30 2534075; fax: +31 30 2534405.
E-mail address: s.m.mohnen@uu.nl (S.M. Mohnen).

0277-9536/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.socscimed.2010.12.004

physical neighborhood characteristics may lead to biased conclusions about the effects of neighborhood social capital. Our contribution inquires into the association between neighborhood social capital and individual health while controlling for these characteristics, in particular socio-economic prosperity and physical maintenance of buildings, as well as relevant individual characteristics. Our representative sample enables us to test arguments on the difference between the effects of social capital in rural and urban regions. We aim to answer the following questions: *Does* neighborhood social capital positively affect individual health? If so, does this effect remain stable when *accounting for* other relevant socio-economic and physical conditions on both the neighborhood and the individual level? *In addition, we want to know whether effects of social capital differ between urban and rural areas in the Netherlands*.

Neighborhood social capital

Neighborhood social capital, or more generally, macro-level social capital, is a resource one can access via membership in a group or community. Social capital on the macro-level—as opposed to micro-level social capital, which operates exclusively on the individual level—consists of norms of reciprocity, civic participation, trust in others, and the benefits of membership. Work by Kawachi, Kennedy, and Glass (1999), Putnam (2000), Subramanian et al. (2003), and, in particular, work on the neighborhood level (Drukker, Buka, Kaplan, McKenzie, & Van Os, 2005; Lochner, Kawachi, Brennan, & Buka, 2003; Poortinga, 2006; Stafford et al., 2008; Van Hooijdonk et al., 2008; Wen et al., 2005) provides examples of this macro-level approach to social capital.

Applying this argument to the field of health, one might expect that neighborhood social capital also enhances an individual's health, and that the more neighborhood social capital one can access, the more one's health would be enhanced. In a neighborhood with much social capital, one would be supported even without asking for help, sometimes even without being aware that one is helped by his neighbors. Intriguingly, even relative strangers can benefit from this public good. For example, people—even if they do not belong to the neighborhood—can safely walk around there at night because the tight community guarantees personal safety (Coleman, 1988).

In previous research, the effects of social capital have been established in rather large geographical units, i.e., at the state or country level (Folland, 2007; Kawachi et al., 1999). However, the argument for the effect of collective social capital can be understood much better at the level of the neighborhood. Moreover, collective social capital can be measured more precisely on relatively smaller geographical units such as neighborhoods. More generally, because individuals spend a large part of their leisure time at home in their neighborhood, it is plausible to expect that they are influenced by their neighbors and their neighborhood environment. According to this reasoning, the density of the population might be of importance. Rural neighborhoods are generally assumed to provide more social capital because people in smaller communities are more likely to know and maintain relationships with each other. However, people in cities share smaller spatial areas and hence, are more aware of and more dependent upon each other. This sharing of smaller areas might result in stronger effects from relationships and social capital, as such. Hence, we can expect that although people in rural areas might create more social capital in their neighborhoods, the returns of social capital, and hence the effects of those returns on health, will be higher in urban areas. Van Hooijdonk et al. (2008) found lower risks for all-cause mortality for urban residents living in neighborhoods with higher social capital, but not for rural residents in high social capital neighborhoods. Until now, we do not have comprehensive information on whether the effects of social capital on self-rated health differ between urban and rural neighborhoods because the research has mainly focused on urban neighborhoods.

We are not the first to study neighborhood social capital and its effect on health (see, e.g., Kawachi et al., 2008). We aim to contribute to the international literature by carefully testing how neighborhood social capital relates to health in the Netherlands, while including socio-economic and physical neighborhood characteristics in the analysis as well as individual characteristics, which are expected to affect health. As already mentioned, our conclusions are based on analysis of large-scale national representative data on individuals and neighborhoods. Moreover, the neighborhoods in this sample are relatively small geographical areas. Lastly, we inquire into the association between social capital and health among urban and rural Dutch areas.

Data, measurements, and analytic strategy

We use two different data sets for information on individuals and neighborhoods. One data set is the 'Housing and Living Survey', called WoOn 2006, commissioned by the Ministry of Housing, Spatial Planning and the Environment (VROM). The WoOn 2006 survey ($n = 64{,}005$) inquires into the housing situation of people in the Netherlands (Van Huijsduijnen et al., 2007, pp. 1–170) and contains information on individual-level characteristics, self-rated health, and information on contacts within the neighborhood. It is representative of residents of the Netherlands who are 18 years old and older. The data were collected between August 2005 and March 2006, and the interviews took about 40 min, on average. The response rate was 56% (see Van Huijsduijnen et al., 2007, pp. 1–170).

Under Dutch privacy legislation, for survey research among the general population no research ethics approval was required.

The information on individual neighborhood contacts enabled us to construct our measurement of neighborhood social capital. These data are enriched by a second data set, which contains information on neighborhoods provided by Statistics Netherlands (CBS) and based on aggregated register information. Both data sets were combined by using the 4-digit postcode areas respondents were living in. Table 1 provides an overview of the number of respondents and neighborhoods used in the analyses and relates them to the Dutch population. Eighty-two percent of all neighborhoods in the Netherlands are represented in our sample. We also inquired into whether these neighborhoods are selective with regard to prosperity and urbanity, but there were no differences between our data and national statistics.

Measurements

Individual characteristics

The dependent variable is self-rated health. It is measured by respondents' self-rating of their health when asked: "In general is

Table 1
Individuals and neighborhoods in this study and in the Netherlands.

	Respondents in sample	Inhabitants of the Netherlands
	WoOn 2006	Statistics Netherlands
Individuals	61,235	16,328,160
Neighborhoods (4-digit postal code)	3273	4002
Average number of individuals per neighborhood	18.7	4080
Year	2006	2006

your health…?" with answers on a 5-point scale ranging from 'very bad' to 'very good'. The variable was dichotomized because its distribution was highly skewed. Using self-rated health as an indicator of actual health is well established, and the correlation with objective health measurements is high (Simon, De Boer, Joung, Bosma, & Mackenbach, 2005).

We further employed socio-demographic variables that have been shown to be important in the analysis of health or for which it is usually controlled. Generally, we used the same control variables as recommended by other researchers in the field (Harpham, 2008, p. 59): sex, coded as a dummy variable; age, measured in years and centered on the average (=47.6 years); and ethnic background, measured by parents' country of birth (Dutch, Western, and Non-Western) combined with information on whether the respondent is a first or second generation immigrant.

In addition, three indicators of social status were used: education, employment, and income. Education was coded as the 'highest educational qualification achieved' at the time of the interview. We used a 5-point scale ranging from 1 (primary school or less) to 5 (university degree). Employment groups include employees/self-employed, those without a paid job, pensioners, recipients of social benefits, and students (at all kinds of schools and universities). Of all WoOn 2006 respondents, 93.8% gave direct information on their income and the income of their partner. For the remaining 6.2% (3.4% tax information; 2.8% imputation of tax information), income information was obtained from the Dutch tax office and added to the data (Van Huijsduijnen et al., 2007, pp. 1–170). In our analyses, income is measured as 'equivalent monthly household income'. This variable takes into account all kinds of income (per household) like social benefits, pensions, and salaries. It is calculated by weighting, on the one hand, the costs of children and, on the other hand, the benefits of sharing a household (Siermann, Van Teeffelen, & Urlings, 2004). If no information about the number of the household members was available, we used unweighted monthly household income (respondents who were not heading a household, such as adult children who participated in the interview, $n = 7630$, were not asked the questions about household, home ownership, and years of residence). For the analyses, the metric variable is presented in deciles, where 0 = negative income, i.e., the income primarily of entrepreneurs who made investments greater than their income; 1 = income up to 599.99 Euros, 2–9 contain income in steps of 300 Euros, and 10 equals an income of 2700 Euros and higher per month. Decile 5 (1200.00 to 1499.99 Euros) is the median and the reference category.

Furthermore, in many neighborhood studies it has been shown that home ownership matters for a number of outcomes (e.g., Harpham, 2008; Ross, Reynolds, & Geis, 2000). It is argued that home owners, in contrast to renters, usually will invest more in the physical and social conditions of their neighborhood (DiPasquale & Glaeser, 1999). We also included an indicator of home ownership, while establishing a difference between 'owner', 'renter', and 'not applicable'. Finally, the years of residence at the given address were included at the individual level to control for the length of the influence of the neighborhood context. This was recorded using the question, "How long have you lived at this address?" For the analyses, we constructed five categories (1) '0–5 years', (2) '6–15 years', (3) '16–25 years', (4) '26 or more years', and a category for missing values. Table 2 presents the descriptive statistics of variables on the individual level. As it can be seen in Table 2, 81% of our respondents rate their health as being good or very good. Furthermore, about 17% have a background other than Dutch, and almost half of the sample is employed or self-employed. Also, approximately half of the sample (47%) owned their home and about 30% lived there between 6 and 15 years.

Table 2
Descriptive statistics of individual variables, source: WoOn 2006 ($n = 61{,}235$ respondents).

	Range	Mean	S.D.	Percent	Missing (n)
Self-rated health					0
Not good (0)				19.0%	
Good or very good (1)				81.0%	
Sex					
Man (1)				47.0%	0
Woman (2)				53.0%	
Age in years	18–103	47.6	18.65		0
Ethnic background					0
Native Dutch				82.7%	
Second generation Western				3.9%	
Second generation Non-Western				1.8%	
First generation Western				4.0%	
First generation Non-Western				7.5%	
Education	1–5	3.4	1.32		0
Occupation					
No job				5.2%	0
(Self-) employed				47.2%	
Pensioner				23.0%	
Welfare recipient				9.7%	
Scholar/student				14.9%	
Income[a]					0
Negative income				0.2%	
Decile 1				2.5%	
Decile 2				3.5%	
Decile 3				13.2%	
Decile 4				16.8%	
Decile 5	(= Median)			17.6%	
Decile 6				14.5%	
Decile 7				10.8%	
Decile 8				7.5%	
Decile 9				4.6%	
Decile 10				8.8%	
Ownership					
Owner (1)				47.2%	
Renter (2)				40.3%	
Not applicable (3)				12.5%	7630
Years of residence		14.2	12.77		
Not applicable (0)				12.5%	7630
0–5 years (1)				26.4%	
6–15 years (2)				30.4%	
16–25 years (3)				14.4%	
≥26 years (4)				16.3%	

[a] Note: in the analyses, deciles 1 and 2 are combined.

Neighborhood characteristics

Our main explanatory variable on the neighborhood level is neighborhood social capital. In the WoOn 2006 data, 'neighborhood social capital' is measured by five questions on contacts among neighbors. Items inquire into the following:

- contact with direct neighbors;
- contact with other neighbors;
- whether people in the neighborhood know each other;
- whether neighbors are friendly to each other; and
- whether there is a friendly and sociable atmosphere in the neighborhood.

Response categories were 'totally agree', 'agree', 'neutral', 'don't agree', and 'totally don't agree' (thus, ranging from 1 to 5). For the analyses, variables and the resulting scales were coded in such a way that higher values indicate more social capital. Note that the items indicating neighborhood social capital focus straightforwardly on access to neighbors and general contacts in the neighborhood. Many other studies have used measurements such as

Table 3
Descriptive statistics of neighborhood variables.

n of neighborhoods = 3273	Data source	Year	*N*	Mean	SD	Range
Neighborhood social capital	WoOn	2006	3495	−0.007	0.716	−3.18–2.14
Highest income quintile	Stat. Neth.[a]	1999–2005	3667	14.2	4.927	0–42.9%
Urbanity of the municipality	Stat. Neth.	1999–2005	3667	3.4	1.345	1–5
Neighborhood home maintenance	WoOn	2006	3495	4.0	0.455	1–5

[a] Stat. Neth. = Statistics Netherlands.

generalized trust. However, this is not necessarily related to local contacts. For the aggregation of our measurement to the level of neighborhoods we applied 'ecometrics' following the work of Raudenbush and Sampson (1999; see the section below on ecometrics).

To take into account the level of income in a neighborhood, we took the percentage of people in the highest income quintile. Hou and Myles (2005) showed that the prosperity of a neighborhood is associated with inhabitants' health, and that this effect is even stronger than the effect of poverty. The data were provided by Statistics Netherlands (CBS). Income includes income from work, one's own company, social benefits, pensions, or financial support for students. Besides inquiring into the effects of prosperity, we also tested the (negative) effects of low income on health while including the percentage of people in the lowest quintile in the analyses, which lead to the same conclusions.

We used the degree of urbanity of the municipality in which a given neighborhood is located. The codes were provided by Statistics Netherlands (CBS), and were based on the number of addresses per km^2 (5 = urban = more than 2499 addresses/km^2; 4 = semi-urban = 1500–2499 addresses/km^2; 3 = intermediate urban-rural = 1000–1499 addresses/km^2; 2 = semi-rural = 500–999 addresses/km^2; and 1 = rural = up to 499 addresses per km^2).

Finally, we used a measure of home maintenance in the neighborhood in order to control for environmental influences on individuals' health. The variable is aggregated to the neighborhood level. Maintenance was addressed with the question, "Is your house in a bad condition?" Answer categories were on a 5-point scale from 'I totally agree' (1) to 'I totally do not agree' (5). Higher values thus indicate better maintenance, as reported by the respondent.

An overview of the neighborhood variables and their sources is given in Table 3.

Note that the information on neighborhoods provided by Statistics Netherlands (CBS) was collected between 1999 and 2005 (see Table 3), or before 2006, which was the year when self-rated health was measured. Correlation of variables at the individual level and neighborhood level are provided in Table 4.

Ecometric-based measurement of neighborhood social capital

To arrive at contextual information from individual data, individual information has to be aggregated to the higher level, which in our case is the neighborhood. The most straightforward procedure of aggregation (see also Cummins, Macintyre, Davidson, & Ellaway, 2005) is to calculate for each neighborhood the average or the standard deviation of the items measured at the individual level (see also Cummins et al., 2005; Stafford et al., 2003). However, this procedure does not solve a number of problems.

First, variables measuring neighborhood social capital are based on individual perception, and it is likely that this perception is influenced by the characteristics of the respondent. For example, older people might compare neighborhood social capital with what they remember from former times and therefore report systematically lower scores of social capital in their current neighborhood than younger people. Another example is women, who on average spend more time in the neighborhood than men and who might thus perceive more neighborhood social capital than their male counterparts.

Second, since the number of respondents differs per neighborhood, the reliability of the aggregated measurement, in our case the social capital measurement, also differs between the neighborhoods.

Third, the items that measure social capital are not independent of each other but nested within respondents; that is, answers on one item are likely to be associated with answers on another item.

In summary, one wants an approach that accounts for individual differences in response to certain items, for differences in numbers of respondents on which the estimation is based, and for dependency among the items that measure social capital. A method that deals with these shortcomings is the recently developed ecometrics approach (see Mujahid, Diez, Roux, Morenoff, & Raghunathan, 2007; Raudenbush & Sampson, 1999). This approach accounts for

Table 4
Correlation of coefficients of individual- and neighborhood-level variables (Spearman's rho).

	n_i = 61,235	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Self-rated health[a]	1.00	–	–	–	–	–	–	–	–	–	–	–	–
2	Sex[a] (1 = woman)	**−0.089	1.00	–	–	–	–	–	–	–	–	–	–	–
3	Age	**−0.319	***0.089	1.00	–	–	–	–	–	–	–	–	–	–
4	Ethnic background[a] (1 = Dutch)	**0.033	−0.006	**0.131	1.00	–	–	–	–	–	–	–	–	–
5	Education	**0.260	**−0.098	***−0.275	**0.014	1.00	–	–	–	–	–	–	–	–
6	Occupation[a] (1= (self-/employee)	**0.269	**−0.146	**−0.314	**0.035	**0.257	1.00	–	–	–	–	–	–	–
7	Income	**0.146	**−0.060	**0.204	**0.137	**0.341	***0.310	1.00	–	–	–	–	–	–
8	Home ownership[a] (1 = owner)	**0.223	**−0.073	**−0.094	**0.152	**0.293	***0.259	**0.467	1.00	–	–	–	–	–
9	Years of residence	**−0.126	**0.023	**0.532	**0.127	**−0.193	***0.189	**0.038	**0.077	1.00	–	–	–	–
10	Neighborhood social capital	**0.153	0.014	0.041	**0.193	0.011	*0.069	**0.130	**0.297	**0.113	1.00	–	–	–
11	Highest income quintile	**0.201	−0.010	0.039	*0.085	**0.178	*0.064	**0.209	**0.180	0.014	**0.105	1.00	–	–
12	Urbanity	*−0.082	−0.016	−0.035	**−0.181	*0.056	−0.042	−0.014	**−0.239	**−0.116	**−0.525	**0.177	1.00	–
13	House maintenance	*0.176	0.013	0.018	**0.152	*0.061	*0.080	**0.109	**0.298	0.024	**0.308	**0.164	**0.188	1.00

n_i = numbers of individuals, $^*p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$.
Correlations between variables at the individual level and variables at the level of the neighborhood are calculated via a multilevel regression model.
[a] dichotomous variable.

the nesting of social capital items within individuals and includes the neighborhood level in the analysis, resulting in a three-level model. One level is for neighborhoods, another is for individuals, and the last is for the items measuring social capital.

We adjusted for seven individual characteristics that can influence the perception of neighborhood social capital, i.e., sex, age, education, income, employment status, home ownership, and years of residence. The ecometric model accounts for differences in the numbers of respondents per neighborhood by shrinking deviating neighborhoods with smaller numbers of respondents to the general average (Hox, 2002, p. 29). The interdependence of individual responses to items is handled by ecometrics via the separate level for the social capital items in the multilevel model.

In the first step of the analysis, neighborhood social capital is estimated by this three-level model. The residuals of the neighborhood social capital measurement, i.e., the part that cannot be attributed to individual response patterns, constitutes the social capital measurement for the final analyses in the second step, where the hypotheses are tested. In this second step, the ecometric-based social capital measurement is used as an independent variable in a two-level logistic model, with a binary indicator for health as dependent variable.

The model estimating neighborhood social capital is as follows:

$$Y_{ijk} = \gamma_{000} + \sum_{m=1}^{4} \alpha_m D_{mijk} + \sum_{q=1}^{7} \delta_q X_{qjk} + v_{00k} + u_{0jk} + e_{ijk},$$

where, Y_{ijk} is the response to item i of person j in neighborhood k, γ_{000} is the grand mean of neighborhood social capital, m is the number of social capital variables (five in total, one serves as reference), D are item dummies, q is the number of individual-level adjusters (7 in total), X are the adjuster variables, v is the neighborhood variance, u is the individual variance, and e is the item variance.

The most important parameters are the neighborhood-level residuals, v, which indicate the degree to which social capital of neighborhood k differs from the grand mean,γ_{000}. These residuals constitute the neighborhood social capital measure. Positive values indicate higher than average levels of neighborhood social capital.

The reliability of ecometric scales depends on the variance at the three levels, i.e., items nested within respondents, and respondents nested within neighborhoods (Hox, 2002, p. 170). The reliability of neighborhood social capital is estimated by

$$\lambda_k = \frac{\sigma^2}{\sigma^2 + \frac{\tau^2}{J_k} + \frac{\omega^2}{nJ_k}},$$

where σ^2 is the variance on neighborhood level, τ^2 is the variance between individuals per neighborhood, and ω^2 is the variance between the items. J_k is the number of individuals in neighborhood $_k$. Finally, n is the number of items to measure neighborhood social capital.

The average reliability of our ecometric-based neighborhood social capital measurement is 0.620. The interpretation is similar to a Cronbach's alpha in psychometrics scale analysis. The range is from 0 to 1, and a value above 0.600 is considered to be adequate (Moss et al., 1998). The correlation—performed at the neighborhood

Table 5
Multilevel logistic regression models of neighborhood social capital on individual health (Odds Ratios, 95% Confidence Interval in parentheses).

$n_i = 61{,}235$	$n_j = 3273$	Model 1	Model 2	Model 3	Model 4
Intercept		1.435 (0.052)***	1.458 (0.052)***	1.470 (0.054)***	1.484 (0.054)***
Individual level					
Gender	Women	0.86 (0.84/0.88)***	0.86 (0.84/0.88)***	0.86 (0.83/0.88)***	0.86 (0.83/0.88)***
Age	(Centered)	0.96 (0.96/0.96)***	0.96 (0.96/0.96)***	0.96 (0.96/0.96)***	0.96 (0.96/0.96)***
Ethnic background (Ref. = Dutch)	2nd gen. Western	0.81 (0.76/0.86)***	0.81 (0.77/0.86)***	0.81 (0.76/0.86)***	0.81 (0.76/0.86)***
	2nd gen. non-West.	0.83 (0.74/0.93)*	0.85 (0.76/0.95)	0.84 (0.75/0.94)	0.85 (0.76/0.95)
	1st gen. Western	0.88 (0.83/0.93)*	0.89 (0.84/0.94)*	0.88 (0.84/0.94)*	0.89 (0.84/0.94)*
	1st gen. non-Western	0.63 (0.60/0.66)***	0.65 (0.62/0.68)***	0.65 (0.62/0.68)***	0.65 (0.62/0.68)***
Education		1.18 (1.17/1.19)***	1.19 (1.17/1.20)***	1.18 (1.17/1.19)***	1.18 (1.17/1.19)***
Occupation (Ref. = (Self-) employed)	No job	0.59 (0.56/0.63)***	0.59 (0.56/0.62)***	0.59 (0.56/0.63)***	0.59 (0.56/0.63)***
	Pensioner	0.68 (0.65/0.71)***	0.68 (0.65/0.71)***	0.68 (0.65/0.71)***	0.68 (0.65/0.71)***
	Welfare recipient	0.19 (0.19/0.20)***	0.20 (0.19/0.20)***	0.20 (0.19/0.20)***	0.20 (0.19/0.20)***
	Student	0.86 (0.82/0.91)***	0.87 (0.82/0.91)**	0.86 (0.82/0.91)**	0.87 (0.82/0.91)**
Income (Ref. = Decile 5)	Negative income	1.94 (1.26/2.91)	1.91 (1.24/2.93)	1.90 (1.24/2.91)	1.89 (1.24/2.91)
	Decile 1 and 2	0.94 (0.87/1.02)	0.94 (0.87/1.02)	0.94 (0.87/1.02)	0.94 (0.87/1.02)
	Decile 3	0.83 (0.79/0.86)***	0.83 (0.79/0.86)***	0.83 (0.80/0.87)***	0.83 (0.80/0.87)***
	Decile 4	0.86 (0.83/0.89)***	0.85 (0.82/0.89)***	0.86 (0.83/0.89)***	0.86 (0.83/0.89)***
	Decile 6	1.10 (1.05/1.14)*	1.10 (1.05/1.14)*	1.09 (1.04/1.14)*	1.09 (1.05/1.14)*
	Decile 7	1.26 (1.20/1.32)***	1.26 (1.20/1.32)***	1.25 (1.19/1.31)***	1.25 (1.19/1.31)***
	Decile 8	1.53 (1.44/1.61)***	1.53 (1.44/1.62)***	1.51 (1.42/1.60)***	1.51 (1.42/1.60)***
	Decile 9	1.50 (1.40/1.61)***	1.51 (1.40/1.62)***	1.48 (1.37/1.59)***	1.48 (1.38/1.59)***
	Decile 10	1.70 (1.60/1.80)***	1.70 (1.61/1.80)***	1.66 (1.56/1.76)***	1.66 (1.56/1.76)***
Ownership (Ref. = Renter)[a]	Owner	1.51 (1.47/1.55)***	1.47 (1.43/1.51)***	1.47 (1.43/1.52)***	1.46 (1.42/1.51)***
	6–15 years	0.93 (0.90/0.96)	0.93 (0.90/0.96)	0.93 (0.90/0.96)	0.93 (0.90/0.96)
Years of Residence (Ref. = 0–5 years)[a]	16–25 years	0.92 (0.89/0.96)	0.92 (0.89/0.96)	0.93 (0.89/0.96)	0.93 (0.89/0.96)
	≥26 years	1.05 (1.01/1.10)	1.05 (1.01/1.09)	1.07 (1.02/1.11)	1.06 (1.02/1.10)
Neighborhood level					
Neighborhood social capital			1.06 (1.05/1.08)***		1.05 (1.03/1.07)**
Highest income quintile				1.01 (1.01/1.01)***	1.01 (1.01/1.01)***
Urbanity of municipality				1.02 (1.00/1.04)	1.02 (1.01/1.04)*
Home maintenance				1.17 (1.12/1.23)***	1.13 (1.08/1.19)**
Variance neighborhood level (se)		0.023 (0.008)**	0.020 (0.007)**	0.015 (0.007)*	0.015 (0.007)*
Intraclass correlation (%)		0.69	0.60	0.45	0.45
Wald test (R^2)		0.320	0.321	0.322	0.323

n_i = numbers of individuals, n_j = numbers of neighborhoods, *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$.
[a] This variable has a missing category that was included to the models but results are not shown here.

level—between an aggregated social capital measure and the econometrics-based social capital measure is 0.797.

Analytic strategy

We used the statistical software package MLwiN 2.15 to perform logistic regression analysis. We estimated the models in MLwiN with second order, PQL estimation. All coefficients are expressed in odds ratios (OR), calculated as exp × coefficient. The confidence interval (CI) is established by exp × (coefficient − standard error) and exp × (coefficient + standard error), respectively. For example (Table 5, model 4), the OR of sex is −0.156 × exp = 0.86, and the CI of sex are exp × (−0.156 − 0.025) = 0.83, and exp × (−0.156 + 0.025) = 0.88. We used a Wald test because in a logistic regression, with its quasi-likelihood estimation, a likelihood ratio test cannot be obtained. The intraclass correlation (ICC) was calculated by the following formula for a multilevel logistic model (see Snijders & Bosker, 1999, p. 224):

$$\mathrm{ICC} = \frac{\sigma^2}{\sigma^2 + 3.29},$$

where σ^2 is the variance on neighborhood level.

We estimated an empty model first to establish the clustering of self-rated health in neighborhoods. Model 1 adds variables on the individual level to measure composition effects. Model 2 adds the first neighborhood-level variable: neighborhood social capital. Model 3 adds the other neighborhood control variables (without neighborhood social capital), and, finally, Model 4 summarizes the full model. These analyses are presented in Table 5. In Table 6, the equations of model 3 and model 4 are repeated for separate categories of urbanity because, as mentioned, we expect differences in the influence of social capital in more urban, as compared with more rural areas.

Results

Dutch neighborhoods differ in the self-rated health of their inhabitants. In the empty model, neighborhood-level variance is 0.120, se = 0.012. The intraclass coefficient is 3.52; in other words, more than 3.5% of the variation in health can be attributed to neighborhood level.

Table 5 shows that all odds ratios of the individual variables are in the expected direction (see model 1). Being female, older than average, non-native Dutch or unemployed all indicate a lower likelihood of reporting a good or very good self-rated health compared to the respective reference group. High education and a high household income predict a better self-rated health. Owning as opposed to renting a house doubles the likelihood of reporting good health. People who moved in the last 5 years have slightly better chances of reporting good health than people who lived between 6 and 25 years at the same address. The odds ratios of all variables on the individual level remain stable across all the models estimated. Compared to the empty model neighborhood-level variance is strongly reduced (but still significant) when individual-level variables are included. This indicates that the clustering of self-rated health is largely, but not entirely, due to social composition.

Model 2 shows that neighborhood social capital has a positive association with individual self-rated health. More generally, the finding indicates that, in addition to the strong compositional effects due to individual characteristics, there is also a relationship between health and neighborhood context. In other words, places, contexts, and their characteristics make a difference alongside individual characteristics. There are places, or neighborhoods,

Table 6
Descriptive statistics and odds ratios per urbanity group for the relation between neighborhood social capital and self-rated health.

Urbanity	n_i/n_j	Good health (average)	Neighborhood social capital, average (range)	(A) Without neighborhood control variables[a,b]		(B) With neighborhood control variables[a,b]	
				Neighborhood social capital, OR (95% CI)	Neighborhood variance, coefficients (standard errors)	Neighborhood social capital, OR (95% CI)	Neighborhood variance, coefficients (standard errors)
5 (urban)	13,622/329	0.79	−1.08 (−3.18/1.27)	1.18 (1.14/1.23)***	0.026 (0.014)*	1.11 (1.06/1.15)**	0.020 (0.013)
4	17,860/648	0.80	−0.61 (−2.73/1.22)	1.02 (0.99/1.06)	0.021 (0.013)	0.96 (0.93/1.00)	0.012 (0.012)
3	12,326/603	0.82	−0.02 (−1.70/2.14)	1.14 (1.10/1.19)***	0.000 (0.000)	1.09 (1.04/1.14)*	0.000 (0.000)
2	9842/759	0.83	0.34 (−1.65/2.03)	1.00 (0.95/1.06)	0.016 (0.023)	1.02 (0.96/1.07)	0.013 (0.023)
1 (rural)	7585/934	0.82	0.46 (−1.02/1.90)	1.07 (1.00/1.14)	0.000 (0.000)	1.07 (1.00/1.14)	0.000 (0.000)

n_i = numbers of individuals, n_j = numbers of neighborhoods, OR = Odds ratio, CI = Confidence Interval, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$.

[a] Neighborhood-level controls were high-income quintile and home maintenance.

[b] All models are adjusted for individual-level gender, age, ethnic background, education, occupation, income, ownership, and years of residence.

where people of all ages and with different levels of prosperity appear to benefit from neighborhood social capital, which is associated with reporting better health.

Model 3 shows that, while controlling for individual income, the percentage of people in the highest income quintile in a neighborhood has a positive association with self-rated health. Furthermore, in model 3 the association of urbanity with self-rated health is on the border of significance. By contrast, better house maintenance in a neighborhood is significantly associated with better self-rated health.

Model 4 shows, in comparison with model 3, that the effect of house maintenance is partially explained by neighborhood social capital. The influence of social capital also remains stable when physical (house maintenance) and socio-economic (relative poverty) neighborhood conditions known to be associated with health are included. If someone lives in a neighborhood with higher than average neighborhood social capital his/her chance of reporting good or very good health is increased by 6%. Thus, other things being equal, collective social capital matters for individual health.

Table 6 summarizes the effects of neighborhood social capital on self-rated health separately for the five urbanity categories. Table 6 shows that 82% of the people in rural areas report good or very good self-rated health, whereas only 79% of the people in urban areas report feeling healthy. Another finding presented in Table 6 suggests that social capital is lower in urban neighborhoods than in rural neighborhoods. Furthermore, Table 6 shows the results of multilevel logistic regression analyses. While health of residents of rural areas does not vary at the neighborhood level, there is significant neighborhood variation in other areas (detailed results not presented). However, after including compositional and contextual variables, there is only variation in health at neighborhood level in very urban neighborhoods.

Interestingly, only the urban and the intermediate urban–rural categories show a significant association between social capital and health. Thus, people in urban (and intermediate urban–rural) areas report on average worse health and less social capital than people in rural areas; however, neighborhood social capital does relate to their health, while it is not associated with the health of 'rural' people.

Discussion

First, our study shows a small but significant clustering of self-rated health in neighborhoods that cannot be explained entirely by social composition. Contextual conditions, or conditions due to the characteristics of the neighborhood such as neighborhood social capital, are also associated with self-rated health. While both socio-economic and physical neighborhood conditions also show a relation with health, the independent effect of social capital remains. However, clustering of health in neighborhoods has been found before in urban or intermediate urban–rural areas, and only in these areas does collective social capital show an independent association with people's health.

Our study has some limitations. First, we cannot completely rule out selection effects. It may be that healthy people move away from low social capital neighborhoods. However, this seems to rarely be the case: a 10-year follow-up study in a Dutch city showed that selective migration hardly contributes to neighborhood inequality in health (Van Lenthe, Martikainen, & Mackenbach, 2007). Furthermore, our data allow for ruling out health-related moves. In our data, a direct question asking for the most important reasons for the last move to another address showed 'health' as being a relatively marginal reason: only 7% ($n = 89$) of those who moved during the last four years mentioned health or health care facilities as being the reason for their moving. Houses, e.g., their size, location, and facilities, were the most important reason for moving. However, health problems might well give rise to other reasons for moving. In order to rule out these potential selection effects we ran two additional analyses. These analyses included one without the eighty-nine people who moved for health-related reasons and one without all of the people that moved; however, the results did not change.

Second, people's willingness to respond to the survey might be related to neighborhood social capital. It could be the case that people who feel better embedded in a neighborhood respond more often to the survey, and those who have fewer contacts refuse to participate. It could also be the case that only healthy people responded, and that those who felt sick did not. If so, then, the variation of both social capital and health will be larger in reality than our results suggest. If these types of biases are present at the same time and variation in the data is lower than in reality, it becomes even more intriguing that health systematically varies with social capital.

The strengths of our contribution are related to the straightforward measurement of neighborhood social capital and the large number of neighborhoods that are studied. First, the way neighborhood social capital is measured is an improvement upon many other studies. In line with theoretical considerations of social capital theory, neighborhood social capital is measured by questions regarding actual interactions between neighbors. Second, we measured neighborhood social capital using ecometrics, which resulted in reliable estimations of neighborhood social capital. Third, we systematically accounted for individual and neighborhood conditions as well, while studying effects of neighborhood social capital.

Our findings are in line with the earlier results of Subramanian et al. (2003) who also established a contextual effect of neighborhood social capital on health in conjunction with the effects of the composition of individuals in a neighborhood. Hence, although the social composition in neighborhoods in terms of income, age, or ethnicity is very important in explaining health, there is an effect of places or contexts that cannot be attributed to differences in composition. Instead, this effect has to be attributed to differences in contextual characteristics; in our case, this effect is associated with differences in collective social capital.

We further want to emphasize that our study demonstrates the importance of physical and socio-economic neighborhood conditions for health. Although there is general agreement that neighborhood environment matters for health, many studies do not include neighborhood variables in the analyses (e.g., Poortinga, 2006; Subramanian et al., 2003). Exceptions are Drukker, Buka, Kaplan, McKenzie, and Van Os (2005) and Van Hooijdonk et al. (2008). Finally, our results suggested that individuals in urban neighborhoods benefited more from social capital although they actually have less social capital to access. This may be partly because the level of social capital is generally lower in urban areas compared to rural ones, so small increments make a larger difference in urban areas. This finding points to the difference between access and use of social capital, which is sometimes made in the literature on social capital at the individual level (see, e.g., Lin, 2000). Having much social capital to dispose of does not imply that one also makes use of it. Perhaps, returns on social capital are greater in cities because people are more aware of each other and are forced to take note of one another. Future research needs to inquire more deeply into this finding as well as the pathways through which neighborhood social capital is effective. A possible mechanism might be related to the availability of amenities and access to health and community services. For example, it is possible that neighborhood social capital improves community capacity to

lobby for provision of services within the neighborhood, and this might explain the health differences between neighborhoods. Furthermore, the interaction of micro social capital, i.e., getting support via direct ties, and macro social capital, i.e., getting support via indirect ties and membership, needs to be understood better in the future.

Acknowledgements

We like to thank the Data Archiving and Networked Services (DANS) that made the free use of WoON 2006 possible. We thank Wouter Steenbeek for his help with applying ecometrics. The article also benefited from comments of ICS colleagues at 'Forum days' and seminars.

References

Beelen, R., Hoek, G., Van den Brandt, P. A., Goldbohm, R. A., Fischer, P., Schouten, L. J., et al. (2008). Long-term effects of traffic-related air pollution on mortality in a Dutch cohort (NLCS-AIR study). *Environmental Health Perspectives, 116*(2), 196–202.

Chung, H. L., & Steinberg, L. (2006). Relations between neighborhood factors, parenting behaviors, peer deviance, and delinquency among serious juvenile offenders. *Developmental Psychology, 42*(2), 319–331.

Coleman, J. S. (1988). Creation and destruction of social capital: implications for the law. *Notre Dame Journal of Law, Ethics and Public Policy, 3*, 375–404.

Cummins, S., Macintyre, S., Davidson, S., & Ellaway, A. (2005). Measuring neighbourhood social and material context: generation and interpretation of ecological data from routine and non-routine sources. *Health & Place, 11*, 249–260.

DiPasquale, D., & Glaeser, G. (1999). Incentives and social capital: are homeowners better citizens? *Journal of Urban Economics, 45*, 354–384.

Diez-Roux, A. V., Nieto, F. J., Muntaner, C., Tyroler, H. A., Comstock, G. W., Shahar, E., et al. (1997). Neighborhood environments and coronary heart disease: a multilevel analysis. *American Journal of Epidemiology, 146*(1), 48–63.

Drukker, M., Buka, S. L., Kaplan, C., McKenzie, K., & Van Os, J. (2005). Social capital and young adolescents' perceived health in different sociocultural settings. *Social Science & Medicine, 61*(1), 185–198.

Fagg, J., Curtis, S., Stansfeld, S. A., Cattell, V., Tupuola, A. M., & Arephin, M. (2008). Area social fragmentation, social support for individuals and psychosocial health in young adults: evidence from a national survey in England. *Social Science & Medicine, 66*(2), 242–254.

Folland, S. (2007). Does "community social capital" contribute to population health? *Social Science & Medicine, 64*(11), 2342–2354.

Halpern, D. (2005). *Social capital*. Cambridge: Polity Press.

Harpham, T. (2008). The measurement of community social capital through surveys. In I. Kawachi, S. V. Subramanian, & D. Kim (Eds.), *Social capital and health* (pp. 51–62). New York, NY: Springer Science and Business Media.

Hou, F., & Myles, J. (2005). Neighbourhood inequality, neighbourhood affluence and population health. *Social Science & Medicine, 60*(7), 1557–1569.

Hox, J. J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah, NJ: Lawrence Erlbaum Associates.

Kawachi, I., Kennedy, B. P., & Glass, R. (1999). Social capital and self-rated health: a contextual analysis. *American Journal of Public Health, 89*(8), 1187–1193.

Kawachi, I., Subramanian, S. V., & Kim, D. (Eds.). (2008). *Social capital and health*. New York, NY: Springer. Science and Business Media.

Lin, N. (2000). Inequality in social capital. *Contemporary Sociology, 29*(6), 785–795.

Lochner, K. A., Kawachi, I., Brennan, R. T., & Buka, S. L. (2003). Social capital and neighborhood mortality rates in Chicago. *Social Science & Medicine, 56*(8), 1797–1805.

Malmström, M., Sundquist, J., & Johansson, S. E. (1999). Neighborhood environment and self-reported health status: a multilevel analysis. *American Journal of Public Health, 89*(8), 1181–1186.

Mayer, S. E., & Jencks, C. (1989). Growing up in poor neighborhoods: how much does it matter? *Science, 243*(4897), 1441–1445.

Moss, S. C., Prosser, H., Costello, H., Simpson, N., Patel, P., Rowe, S., et al. (1998). Reliability and validity of the PAS-ADD checklist for detecting psychiatric disorders in adults with intellectual disability. *Journal of Intellectual Disability Research, 42*, 173–183.

Mujahid, M. S., Diez-Roux, A. V., Morenoff, J. D., & Raghunathan, T. (2007). Assessing the measurement properties of neighborhood scales: from psychometrics to ecometrics. *American Journal of Epidemiology, 165*, 858–867.

Poortinga, W. (2006). Social relations or social capital? Individual and community health effects of bonding social capital. *Social Science & Medicine, 63*(1), 255–270.

Putnam, R. D. (2000). *Bowling alone, the collapse and revival of civic America*. New York, NY: Simon & Schuster.

Raudenbush, S. W., & Sampson, R. J. (1999). Ecometrics: toward a science of assessing ecological settings, with application to the systematic social observation of neighborhoods. *Sociological Methodology, 29*(1), 1–41.

Ross, C. E., Reynolds, J. R., & Geis, K. J. (2000). The contingent meaning of neighborhood stability for residents' psychological well-being. *American Sociological Review, 65*, 581–597.

Siermann, C. L. J., Van Teeffelen, P. J. J., & Urlings, L. J. M. (2004). *Equivalent factors 1995–2000*. Voorburg/Heerlen: Statistics Netherlands.

Simon, J. G., De Boer, J. B., Joung, I. M. A., Bosma, H., & Mackenbach, J. P. (2005). How is your health in general? A qualitative study on self-assessed health. *The European Journal of Public Health, 15*(2), 200–208.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: an introduction to basic and advanced multilevel modeling*. Thousand Oaks, CA: Sage Publishers.

Stafford, M., Bartley, M., Sacker, A., Marmot, M., Wilkinson, R., Boreham, R., et al. (2003). Measuring the social environment: social cohesion and material deprivation in English and Scottish neighbourhoods. *Environment and Planning A, 35*(8), 1459–1475.

Stafford, M., De Silva, M., Stansfeld, S., & Marmot, M. (2008). Neighbourhood social capital and common mental disorder: testing the link in a general population sample. *Health and Place, 14*, 394–405.

Subramanian, S. V., Lochner, K. A., & Kawachi, I. (2003). Neighborhood differences in social capital: a compositional artifact or a contextual construct? *Health and Place, 9*(1), 33–44.

Van Hooijdonk, C., Droomers, M., Deerenberg, I. M., Mackenbach, J. P., & Kunst, A. E. (2008). The diversity in associations between community social capital and health per health outcome, population group and location studied. *International Journal of Epidemiology, 37*(6), 1384–1392.

Van Huijsduijnen, J. H., Van Til, R. J., Verhoog, E., Gopal, K., Ferment, B., & Van Galen, J. (2007). *WoON 2006 Onderzoeksdocumentatie – Module Woningmarkt*. [*WoOn 2006 documentation of the housing demand survey – Module housing market*]. Delft: The Netherlands Ministry of Housing, Spatial Planning and Environment [Ministerie van VROM].

Van Lenthe, F. J., & Mackenbach, J. P. (2002). Neighbourhood deprivation and overweight: the GLOBE study. *International Journal of Obesity and Related Metabolic Disorders, 26*(2), 234–240.

Van Lenthe, F. J., Martikainen, P., & Mackenbach, J. P. (2007). Neighbourhood inequalities in health and health-related behaviour: results of selective migration? *Health & Place, 13*, 123–137.

Veenstra, G., Luginaah, I., Wakefield, S., Birch, S., Eyles, J., & Elliotte, S. (2005). Who you know, where you live: social capital, neighbourhood and health. *Social Science & Medicine, 60*, 2799–2818.

Völker, B., Flap, H., & Lindenberg, S. (2007). When are neighbourhoods communities? Community in Dutch neighbourhoods. *European Sociological Review, 23*(1), 99–114.

Wen, M., Cagney, K. A., & Christakis, N. A. (2005). Effect of specific aspects of community social environment on the mortality of individuals diagnosed with serious illness. *Social Science & Medicine, 61*(6), 1119–1134.

Wilson, W. J. (1996). When work disappears. *Political Science Quarterly, 111*(4), 567–595.